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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TOSHIHIDE ITO
and SHIRO HARA

Appeal 2007-4241
Application 09/671,084
Technology Center 1700

Decided: March 21, 2008

Before CHUNG K. PAK, CHARLES F. WARREN, and
LINDA M. GAUDETTE, *Administrative Patent Judges*.

PAK, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the Examiner's final rejection of claims 1 through 3, 5, 6, and 8, all of the claims pending in the above-identified application. We have jurisdiction pursuant to 35 U.S.C. § 6.

We AFFIRM.

STATEMENT OF THE CASE

The subject matter on appeal is directed to a lead-free solder composition that effectively suppresses copper leaching (Spec. 4, ll. 17-24). Further details of the appealed subject matter are recited in claims 1 through 3, 5, 6, and 8 reproduced below:

1. A lead-free solder consisting essentially of:
 - (a) 1.0 to 2.0 wt.% of Ag;
 - (b) 0.4 to 0.9 wt.% of Cu;
 - (c) 0.02 to 0.06 wt.% of Ni; and
 - (d) a balance of Sn;wherein said solder has a liquidus temperature of 240°C or lower.
2. The solder according to claim 1, wherein the content of Ni is in a range from 0.02 to 0.04 wt.%.
3. The solder according to claim 1, wherein said solder having a copper dissolution rate of 0.20 $\mu\text{m}/\text{sec}$ or less.
5. The solder according to claim 1, wherein said solder having a liquidus temperature of 230°C or lower.
6. The solder according to claim 1, wherein said solder has a viscosity of 2.5 cP or lower.
8. The solder according to claim 1, further containing 0.02 to 0.06 wt.% Fe.

As evidence of unpatentability of the claimed subject matter, the Examiner has relied upon the following references:

Murata	6,241,942	Jun. 5, 2001
Chagi	JP 10-34376	Feb. 10, 1998 ¹
Kubota	JP 8-132279	May 28, 1996 ²
Yamashita '689	JP 10-286689	Oct. 27, 1998 ³

The Examiner has rejected the claims on appeal as follows:

- 1) Claims 1-3 and 5-6 under 35 U.S.C. § 103(a) as unpatentable over the disclosures of Yamashita '689, Chagi, or Murata; and
- 2) Claims 1-3, 5-6, and 8 under 35 U.S.C. § 103(a) as unpatentable over the disclosure of Kubota.

The Appellants appeal from the Examiner's decision rejecting the claims on appeal under 35 U.S.C. § 103(a).

¹ Our reference to Chagi is to the translation thereof prepared for the U.S. Patent and Trademark Office by The McElroy Translation Company (PTO 06-1910 January 2006).

² Our reference to Kubota is to the translation thereof prepared for the U.S. Patent and Trademark Office by The McElroy Translation Company (PTO 06-1911 January 2006).

³ This opinion refers to the machine English translation of Yamashita '689 prepared by the Japanese Patent Office and relied upon by the Examiner. Appellants do not dispute or question the Examiner's statement in the Examiner's Answer dated August 12, 2005, that references Yamashita '689 and DE 19816671 are equivalent to one another. However, we will limit our discussion to Yamashita '689 because the body of the rejection set forth in the Answer relies on Yamashita '689 (not DE 19816671). In addition, we note the Appellants refer to US 6,179,935, issued to Yamashita et al. on January 30, 2001 (Yamashita et al. '935), as if it were part of the Examiner's rejection (Br. 7-8). We will not consider Yamashita et al. '935 since it is not included in the Examiner's statement of the rejection. *In re Hoch*, 428 F.2d 1341, 1342 n.3 (CCPA 1970).

PRINCIPLES OF LAW, FACTUAL FINDINGS, ISSUES, AND ANALYSES

Under 35 U.S.C. § 103, the factual inquiry into obviousness requires a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). “[A]nalysis [of whether the subject matter of a claim would have been obvious] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-41 (2007) (*quoting In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

REJECTIONS OF CLAIMS 1, 2, and 5

The Examiner has set forth two grounds of rejection applicable to claims 1, 2, and 5. (Ans. 4-6). The Examiner has rejected claims 1, 2, and 5 under 35 U.S.C. § 103(a) as unpatentable over the disclosure of either Chagi, Murata, or Yamashita '689. *Id.* The Examiner has also rejected the same claims under 35 U.S.C. § 103(a) as unpatentable over the disclosure of Kubota. *Id.*

Appellants acknowledge that Chagi, Kubota, Murata, and Yamashita '689 all disclose solder compositions having a liquidus temperature of less than or equal to 240°C. (Br.11 and 14). These solder compositions, according to the Examiner, have overlapping amounts of all the ingredients

recited in claims 1, 2, and 5. (Ans. 4-5). This Examiner's finding is supported by Chagi, Murata, and Yamashita '689 as well as Kubota,. We find that Chagi, for example, describes (§¶ 0005) a lead-free solder composition having 0.1-5 percent silver, 0.05-2 percent copper, 0.0005-0.1 percent nickel, 0.1-10 percent bismuth, 0.0005-0.01 percent phosphorous, and the remainder tin. We find that Yamashita '689 describes (abstract and Table 1) a lead-free solder composition having 1.0 percent or less silver, 2.5-3.5 percent copper, 1.0 to 3.5 percent nickel, 1 percent or less antimony, and the balance tin. We find that Kubota describes (§¶ 0012 and Table 1) a lead-free solder composition having less than 3 percent copper and less than five percent of the following optional components: silver, indium, antimony, nickel, iron, and bismuth.

Under these circumstances, we determine that the prior art references relied upon by the Examiner would have suggested employing the claimed amounts of the stated ingredients of the solder composition within the meaning of 35 U.S.C. §103. As stated in *In re Peterson*, 315 F.3d 1325, 1329 (Fed Cir. 2003):

In cases involving overlapping ranges, we and our predecessor court have consistently held that even a slight overlap in range establishes a *prima facie* case of obviousness. *E.g.*, *In re Woodruff*, 919 F.2d at 1578, 16 USPQ2d at 1936-37 (concluding that a claimed invention was rendered obvious by a prior art reference whose disclosed range ("about 1-5%" carbon monoxide) abutted the claimed range ("more than 5% to about 25%" carbon monoxide)); *In re Malagari*, 499 F.2d at 1303, 182 USPQ at 553 (concluding that a claimed invention was rendered *prima facie* obvious by a prior art reference whose disclosed range (0.020-0.035% carbon) overlapped the claimed range (0.030-0.070% carbon)); *see also In re Geisler*, 116 F.3d at 1469, 43 USPQ2d at 1365 (acknowledging that a claimed invention was

rendered *prima facie* obvious by a prior art reference whose disclosed range (50-100 Angstroms) overlapped the claimed range (100-600 Angstroms)). We have also held that a *prima facie* case of obviousness exists when the claimed range and the prior art range do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 783, 227 USPQ 773, 779 (Fed. Cir. 1985) (concluding that a claim directed to an alloy containing “0.8% nickel, 0.3% molybdenum, up to 0.1% maximum iron, balance titanium” would have been *prima facie* obvious in view of a reference disclosing alloys containing 0.75% nickel, 0.25% molybdenum, balance titanium and 0.94% nickel, 0.31% molybdenum, balance titanium).

Appellants argue that claim 1, by virtue of employing the limitation “consisting essentially of,” excludes unclaimed additional ingredients, such as bismuth, antimony, indium, and zinc taught by the prior art references, because they are material to the basic and novel characteristics of the claimed solder composition. (Br.7 and 14). The Examiner, on the other hand, takes the position that the additional ingredients taught by the prior art are not excluded by the claimed solder composition. (Ans. 8).

Therefore, the initial issue is whether Appellants have demonstrated that the additional ingredients taught by the prior art references materially affect the basic and novel characteristics of the claimed solder composition.

It is well settled that Appellants have the burden of showing that the additional ingredients taught by the prior art references affect the basic and novel characteristic of a claimed solder composition. *In re De Lajarte*, 337 F.2d 870, 874 (CCPA 1964). However, Appellants have not carried their burden. There simply is nothing in the prior art references or in the Specification, which indicates that the additional ingredients taught by the

prior art references would deleteriously or materially affect the basic and novel function of the claimed solder composition. *In re Herz*, 537 F.2d 549, 551-52 (CCPA 1976). In fact, it can be inferred from page 13 of the Specification that the limitation “consisting essentially of” does not preclude the presence of such additional unclaimed ingredients in the claimed solder composition. This inference is further supported by dependent claim 8, which, by virtue of including an additional solder ingredient, indicates that the term “consisting essentially of” recited in claim 1 is not intended to exclude additional components. Thus, we concur with the Examiner that the claims, as recited, do not exclude the additional ingredients taught in the prior art references.

As a rebuttal to the prima facie case of obviousness established by the Examiner, Appellants contend that the claimed subject matter imparts surprising and unexpected results. (See Br. 6-10 and 14-15). In support of this contention, Appellants refer to Documents 1 and 3 attached to Exhibit A of the Brief. According to the Appellants, Document 3 shows that the liquidus temperature surprisingly remains at approximately the same temperature when the copper content is in a range of 0.4-0.9 percent, with the silver content varying over a range of about 1-2 percent. *Id.* at 7. Additionally, Document 1 is said to show that the liquidus temperature surprisingly remains low when the silver content is in the range of 1-2 percent, with the nickel content varying over a range of 0-0.06 percent. *Id.* at 6. Document 1 shows samples 1-6, 62-67, 73-78, 84-89, and 95-100 from pages 24, 32, 27, 35, 28, and 36 of Appellants' Specification. Document 3 in its entirety reflects the data found at page 17 of Appellants' Specification.

The tests directed to samples N18-N23 in Document 1 are not from Appellants' Specification. Nor were they submitted or presented in the form of an affidavit or declaration. Accordingly, the Appellants' reliance on samples N18-N23 is treated as a mere argument unsupported by any factual evidence. *In re Mehta*, 347 F.2d 859, 866 (CCPA 1965)(treating an unsworn exhibit as mere argument, not factual evidence).

Appellants have the burden of showing unexpected results with respect to the claimed subject matter. *See e.g., In re Klosak*, 455 F.2d 1077, 1080 (CCPA 1972). However, as correctly pointed out by the Examiner at page 5 of the Answer, the Appellants have not carried their burden.

Initially we note that Appellants have not averred anywhere in the Specification or any other evidentiary submission such as an affidavit or declaration that the results would be unexpected to one of ordinary skill in the art. *In re Geisler*, 116 F.3d 1465,1470 (Fed. Cir. 1997). Thus, Appellants cannot overcome the Examiner's prima facie case of obviousness. As noted in *In re Soni*, 54 F.3d 746,750 (Fed. Cir.1995), the Appellants' attorney argument in the Brief is "insufficient to establish unexpected results."

To the extent that the Appellants may have averred that Documents 1 and 3 show unexpected results, they have not demonstrated that the claimed subject matter imparts unexpected results over the closest prior art references, e.g., Yamashita '689 and Chagi. *In re Johnson*, 747 F.2d 1456, 1461 (Fed. Cir. 1984). The closest prior art references involve lead-free solder compositions having liquidus temperatures of 240°C or lower. Yamashita '689, for example, employs in Table 1 a lead-free solder

composition having 1 percent silver, 0.5 percent copper, 0.2 percent nickel, 3.0 percent antimony, and the remainder tin; Chagi employs in Table 1 a lead-free solder composition having 5 percent bismuth, 2 percent silver, 0.5 percent copper, 0.005 percent nickel, 0.001 percent phosphorous, and the remainder tin. These exemplified solder compositions employ the amounts of copper and silver within the claimed amount and the amount of nickel close to the claimed amount. Appellants have not directed us to any comparative data, however, showing that the claimed solder compositions are unexpectedly superior to these closest prior art solder compositions. Appellants' samples 62-67 and 73-78 in Document 1, for example, show that silver contents of 0.5 percent and 1 percent will yield a liquidus temperature of about 220° C, irrespective of the nickel amount up to 0.1 percent. Even were we to consider Samples N18-N23 as factual evidence, Document 1 shows that silver contents of 0.5 percent and 2 percent will yield a liquidus temperature of about 220° C, irrespective of the nickel amount up to 0.1 percent. Appellants' Document 3 shows that a copper and silver content of about 0.5 percent and 1-2 percent, respectively, yields a liquidus temperature of 225° C. Documents 1 and 3 do not prove that the claimed invention imparts unexpected results over the closest prior art solder compositions. Rather, they show that the closest prior art solder compositions, like the claimed solder compositions, would have a low liquidus temperature.

In addition, we find that the showing in the Document 1 is not commensurate in scope with the degree of protection sought by the appealed claims even if we were to consider samples N18 through N23 in Document 1 as factual evidence. *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983); *In*

re Kollman, 595 F.2d 48, 56 (CCPA 1979). While Appellants' showing in Document 1 is limited to tin-silver-copper-nickel solder, the appealed claims are not so limited. Claim 1 embraces solder compositions different from those shown in Document 1. Specifically, the claimed solder compositions include proportions of silver, nickel, copper, tin and other additional ingredients not found in Document 1. On this record, Appellants have not shown that the results shown in Document 1 of Exhibit A are applicable to all solder compositions embraced by claim 1.

Accordingly, based on the factual findings set forth in the Answer and above, we determine that the preponderance of evidence weighs most heavily in favor of obviousness of the subject matter defined by claims 1, 2, and 5 within the meaning of 35 U.S.C. § 103.

REJECTIONS OF CLAIM 3

With respect to claim 3, Appellants argue the prior art references do not teach the claimed copper dissolution rate. (Br. 11-12 and 15). While it is true that the prior art is silent with respect to the copper dissolution rate, Appellants' own data indicate that the closest prior art solder compositions would necessarily have the claimed copper dissolution rate. *See* Spec. Table 5. Specifically, we find that Appellants' data at pages 20 and 21 of the Specification indicate that copper dissolution is a function of the copper and silver contents. The closest prior art solder compositions exemplified in, for example, Yamashita '689 and Chagi have the claimed copper and silver contents which, according to Appellants' data at Table 5 of the Specification, are said to provide the claimed copper dissolution rate. On

this record, Appellants have not shown that that the closest prior art solder compositions exemplified in the prior art do not possess the claimed copper dissolution rate.

REJECTIONS OF CLAIM 6

With respect to claim 6, Appellants argue that the prior art references do not teach the claimed viscosity rate. (Br. 12 and 16). While it is true that the prior art is silent with respect to the claimed viscosity rate, we find that the claimed viscosity rate would necessarily follow from the suggestion of the prior art references. *Ex parte Obiaya*, 227 USPQ 58, 60 (BPAI 1985). Specifically, we find that Appellants admit that that the claimed viscosity is a function of the proportions between silver and nickel and silver and copper. (Br. 12 and 16). The closet prior art solder compositions exemplified in, for example, Yamashita '689 and Chagi have the claimed copper, silver, and nickel contents which, according to Appellants' own admission provide the claimed viscosity rate. On this record, Appellants have not shown that that the closest solder compositions exemplified in the prior art do not possess the claimed viscosity rate.

REJECTION OF CLAIM 8

As to claim 8, we find Kubota describes (¶ 0012 and Table 1) a lead-free solder composition having less than 3 percent copper and less than five percent of the following optional components: silver, indium, antimony, nickel, iron, and bismuth. Therefore, we concur with the Examiner that Kubota teaches all the claimed ingredients in amounts, which overlap with

those recited in claim 8. Accordingly, we agree with the Examiner that it would have been obvious to one of ordinary skill in the art to employ the claimed amounts of the claimed ingredients, including iron, within the meaning of 35 U.S.C. § 103(a). *Peterson*, 315 F.3d at 1330.

As a rebuttal to the prima facie case of obviousness established by the Examiner, Appellants contend that the “Additional Table” attached to Exhibit A of the Brief shows the iron content of 0.02-0.06 percent is a critical range that suppresses copper dissolution. (Br. 17). The Additional Table shows samples 73-78 from pages 27 and 35 of Appellants' Specification. The tests directed to samples N18-N23 and N29-N38 in the Additional Table are not from Appellants' Specification. Nor were they submitted or presented in the form of an affidavit or declaration. Accordingly, the Appellants' reliance on samples N18-N23 and N29-N38 in the Additional Table is treated as a mere argument unsupported by any factual evidence. *Mehta*, 347 F.2d at 866.

As indicated earlier, Appellants have the burden of showing unexpected results with respect to the claimed subject matter. *Klosak*, 455 F.2d at 1080. However, as correctly pointed out by the Examiner at pages 5-6 of the Answer, Appellants have not carried their burden.

Initially we note that Appellants have not averred anywhere in the Specification or any other evidentiary submission such as an affidavit or declaration that the results would be unexpected to one of ordinary skill in the art. *Geisler*, 116 F.3d at 1470. Thus, Appellants cannot overcome the Examiner's prima facie case of obviousness. As noted in *Soni*, 54 F.3d at

750, Appellants' attorney argument in the Brief is "insufficient to establish unexpected results."

To the extent that the Appellants may have averred that the Additional Table shows unexpected results, we find that Appellants have not demonstrated that the showing in the Additional Table is commensurate in scope with the degree of protection sought by the appealed claims. *Grasselli*, 713 F.2d at 743; *Kollman*, 595 F.2d at 56. While Appellants' showing in the Additional Table is limited to solder compositions containing specific proportions of tin-silver-copper-nickel-iron, the appealed claims are not so limited. The claims embrace solder compositions different from those shown in the Additional Table. Specifically, the solder compositions, as recited in claim 1, include other ingredients not included in the Additional Table and the proportions of silver, nickel, copper, and tin not included in Additional Table. On this record, Appellants have not evinced that the limited showing in the Additional Table is predictive of the solder compositions embraced by claim 8, but not shown in the Additional Table. Indeed, the Additional Table shows that the proportions of ingredients employed can dramatically affect the copper dissolution rate of a solder composition.

Accordingly, based on the factual findings set forth in the Answer and above, we determine that the preponderance of evidence weighs most heavily in favor of obviousness of the subject matter defined by claim 8 within the meaning of 35 U.S.C. § 103.

ORDER

The decision of the Examiner is affirmed.

TIME PERIOD

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

tf/ljs

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